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Research Article

From burrows to spotlight: first description of the female of *Eresus lavrosii* Mcheidze, 1997 (Araneae, Eresidae), with notes on the natural history

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Abstract

Eresidae (velvet spiders) is a relatively small family of spiders, most-diversified in the African continent. The present study provides the first description of the female of *Eresus lavrosii* Mcheidze, 1997, which has remained undiscovered for over two decades. We also briefly review the species' history and add knowledge of its ecology, biology, and distribution. Diagnostic drawings and digital photographs of female and male copulatory organs, alongside COI barcoding results, photographs of live and preserved specimens, and of microhabitat are also presented.

Key words: Araneomorphae, diet, Georgia, grazing, South Caucasus, spider, taxonomy

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Introduction

Eresidae C.L. Koch, 1845 is a relatively small family of heavily-built spiders, comprising 109 known species in nine genera occurring in a variety of habitats. It is primarily distributed in the Palaearctic and Afrotropical regions; however, a handful of species are documented from the Oriental region and South America (WSC 2025). Their stocky bodies are covered in glossy, thick, and dense hair, imparting an appearance reflected in the vernacular name of the family, "velvet spiders". Members of the nominate and morphologically conservative genus *Eresus* Walckenaer, 1805, colloquially known as "ladybird spiders", display striking sexual dimorphism. The females typically have subdued or uniformly-coloured abdomens; in contrast, the males usually have bright red abdomens with black spots or other patterns around sigilla, sometimes accompanied with white margins. Despite this engaging appearance, that has aroused fascination and interest amongst scientists throughout the centuries (Schäffer 1779; Drapiez 1837), and their recognised conservation value (Seppälä et al. 2018; Milano et al. 2021), even seemingly well-studied taxon continue to yield unexpected discoveries (Řezáč et al. 2008; Kovács et al. 2015), especially when aspects of their biology remain understudied (Zarcos and Pinero 2018). Studying the biol-

ogy of these spiders is particularly challenging, as the active period of males is relatively short and there are very different lifestyles between sexes. Adult females and juveniles of most species are strictly subterranean and sedentary (for exceptions see Řezáč et al. 2023), rarely leaving their burrows (Figs 4A–B), whereas adult males actively wander in search of females during the copulation period. This is reflected in the fact that amongst the 25 known species and five subspecies of the genus *Eresus*, both sexes have been described for only six species, the rest being based on a single sex or even just juveniles (*E. albopictus* Simon, 1873, but see Řezáč et al. 2023).

To date, the Caucasus region, and specifically Georgia, is host to three eresid species from two genera (Nentwig et al. 2025; WSC 2025), namely *Eresus kollari* Rossi, 1846, *E. lavrosii* Mcheidze, 1997, and the recently recorded *Stegodyphus lineatus* (Latreille, 1817) (Seropian et al. 2023). Of these, *E. lavrosii* is the most iconic and enigmatic local species; Mcheidze (1997) described the first three males from the vicinity of Udzo Monastery (Kojori) and named it *E. lavrosiae* ('lapsus calami' per ICZN Article 32.5.1) after her husband Lavrosi Kutubidze. In striking contrast to the "typical" colouration of male *Eresus*, males of *E. lavrosii* have white abdomens with a black, broad, and continuous oval-shaped patch with irregular ridges. For more than two decades, this species retained the status of local endemic - known only from the type locality, until it was subsequently reported from Türkiye (Zamani et al. 2020), Iran (Zamani et al. 2022), and Armenia (Zarikian et al. 2023), expanding its known distribution to the south. However, all of these studies were based solely on males. The aims of this study are twofold: 1) to provide the first description of the female of *E. lavrosii*, and 2) to contribute to the knowledge of the ecological, biological, and distributional aspects of the species.

Material and methods

Sampling methods

The studied material was collected from 2021 to 2024 during expeditions under the CaBOL (Caucasus Barcode of Life) project and short excursions to nearby areas conducted by the authors. A pair (male and the copulated female with a secretion mating plug) was collected from the same burrow. The specimens were collected individually, preserved in 96% ethanol, and stored in a freezer at -22˚C at the scientific collections of Ilia State University (Georgia, Tbilisi). Sampling details are given in the Results section. The altitudinal data and GPS coordinates (given in WGS84) were obtained using a Garmin GPS MAP 64s. Statistical analysis was performed in RStudio (version 2024.4.2.764) (R core team 2024). Photographs of live and preserved specimens were taken using a Canon EOS 5D Mark II camera with a Canon MP-E 65mm f/2.8 1–5× Macro Photo Lens mounted on a Novoflex Castel-L Focusing Rack. Digital images were prepared using Zerene Stacker image stacking software and Adobe Photoshop CS6 (version 13.0). The copulatory organs were drawn based on microscope photographs using a Wacom CTH-690 Intuos Medium Pen and Touch Tablet with the programs Krita (version 2.9.7) and Photoshop CS6 (version 13.0). The epigyne was cleared and cleaned using a 30% solution of potassium hydroxide. All measurements are given in mm. The barcoding was undertaken within the BIOSCAN project

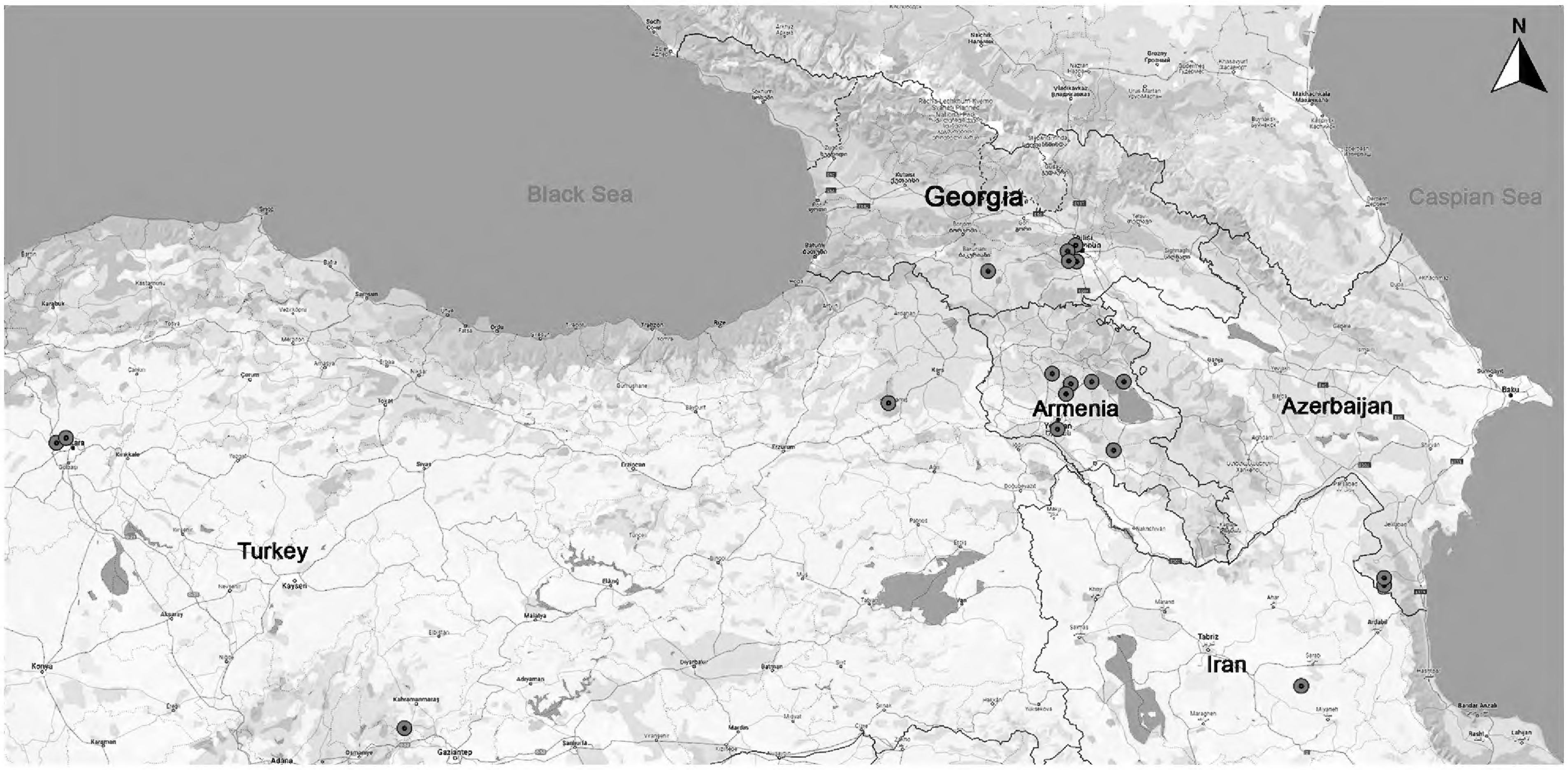

Figure 1. Known localities of *Eresus lavrosii*.

(Hobern 2020). The newly obtained COI sequences were compared with each other and checked against the BOLD Systems database (http://www.boldsystems.org/index.php), where they were recently uploaded. Barcode Index Number (BIN) (Ratnasingham and Hebert 2013) for the sequenced taxa and their nearest neighbour in BOLD Systems are also given. For the calculation of sequence differentiation, we used *p*-distance as performed in the BOLD Systems.

The following abbreviations used in the text and figures follow Miller et al. (2012): Fe (femur), Pt (patella), Ti (tibia), Mt (metatarsus), Ta (tarsus), ACS (anterior section of copulatory ducts), EF (epigynal fissures), ML (median lobe), S (spermathecae). Abbreviations used in the text and tables to identify the data source are: FBWG (Facebook group "Wildlife in Georgia"), GBD (Georgian Biodiversity Database), GGBC (Georgian-German Biodiversity Center).

Ecological survey

In the last few decades, citizen science has increasing gained recognition in scientific circles (Bauer 2021; Connors et al. 2023). Consequently, it would be unreasonable to neglect publicly-available and valuable data from open-source online platforms and databases such as iNaturalist, the Facebook group – FBWG, and GBD (Tarkhnishvili et al. 2025). To obtain comprehensive data and an understanding of the distributional and biological aspects of *E. lavrosii*, as well as using traditional methods, the information deposited in these sources was utilised (Table 1). As a result, a map of occurrences was generated in ArcGIS Desktop 10.5 based on the aggregated GPS data (Fig 1).

Population density, age structure, viability, and natural diet analyses were performed at the type locality in the vicinity of Udzo Monastery (Kojori, N41.8040°, E44.6860°), where a 50 m² square plot (5x10 m) was defined and delimited. The location was selected based on its relative accessibility and proximity to the first author's residence, as well as personal data on *E. lavrosii* distribution collected over the past few years.

Table 1. Length of leg measurements.

	Fe	Pt	Ti	Mt	Ta	Total
I	4.48	2.16	2.61	2.13	1.82	13.20
II	4.42	2.32	2.48	2.12	1.94	13.28
III	4.11	2.24	2.32	1.84	1.09	11.6
IV	6.10	2.14	2.54	2.62	1.10	14.5

Population density was estimated on 27 May 2024 by calculating the number of occupied underground burrows on the study plot (Suppl. material 1). To prevent double counting, burrows were marked with coloured flags. The density was calculated using the equation Dp = N/A, where N represents the number of occupied burrows and A denotes the plot area expressed in m^2.

Amongst other local araneomorph spiders, Eresidae, and in particular representatives of the genus *Eresus*, are unique in their long lifespan (Gauckler 1971; Kusnetsov 1985; Wisniewski and Hughes 1998; Walter 1999). The combination of longevity, subsocial lifestyle, and low dispersal abilities of the juveniles (but see Rozwałka et al. 2019) results in a gradient of age structure within the population. To analyse this age structure and viability, the diameters of the burrow entrances were measured. Measurements of the entrance holes' diameters of the occupied burrows were performed using a Tolsen 35053 digital caliper (0.01 mm accuracy) (Suppl. material 1). Specimens of different life stages (adults, subadults, and juveniles) were extracted from the burrows to evaluate the correlation between the diameter of the burrows and life stage. The differences between burrow sizes amongst life stage classes were tested using a student's t-test. The obtained result was then extrapolated to verify the life stages of the rest of the burrow inhabitants without their extraction and disturbance.

To analyse the natural diet and its changes during the different life stages of *E. lavrosii*, the tents (aboveground parts of the webs) were collected and placed in vials for each previously measured inhabited burrow. Members of the genus *Eresus* use these sheet-like webs not only for camouflaging their burrows but also for storing the prey residues, which they attach to the inner side (Zarcos and Piñero 2016). Each vial containing the collected tent was labelled according to the measurements of the burrows and their inhabitants. Under laboratory conditions, prey remains were carefully separated from the web, identified to the lowest possible taxonomic level, and counted (Suppl. material 2). For the identification, we used a Zeiss Stemi 508 Stereo Microscope with 8:1 Zoom and a Zeiss Apo 1.5x FWD 53 mm front lens attached.

Results

Taxonomy

***Eresus lavrosii* Mcheidze, 1997**
Figs 2A–D, 3A–G, 4A–G

Eresus lavrosiae Mcheidze 1997: 48, figs 28–29 (♂).
Eresus lavrosiae:Zamani et al. 2020: 564, figs 15–22, 28–29, 34 (♂).

Material examined. GEORGIA • Kiketi; 1♀; N41.6389°, E44.6457°; 1088 m a.s.l.; edge of deciduous forest, meadow; leg. Bulbulashvili N.; 23 May 2021; CaBOL-ID 1010321. • Tetrobi Managed Reserve; 1♂ (subadult); N41.5843°, E43.3965°; 2004 m a.s.l.; edge of coniferous forest, meadow; leg. Bulbulashvili N.; 15 Oct. 2022; CaBOL-ID 1035445. • Udzo Monastery, Kojori; 1♂; N41.6758°, E44.7009°; 1406 m a.s.l.; forest edge, meadow; leg. Makharadze G.; 27 May 2024; CaBOL-ID 1037403 (BGE_00657_E11). • 1♂; 29 Apr. 2024; CaBOL-ID 1037402 (BGE_00657_E10).

Diagnosis. Females of *E. lavrosii* are similar to those of *E. moravicus* Řezáč, 2008 by a pars cephalica covered with dense short yellow hair and a uniformly black abdomen. They can be distinguished from *E. moravicus* by femora I–IV ventrally and sternum with yellow and off-white macrosetae (vs. completely black) (Figs 3D, 4F–G; cf. Kovács et al. 2015: fig. 1C; personal communication with Gábor Kovács), shorter and wider epigyne, significantly wider and more extensive median lobe (Fig. 2A, C), more globular anterior sections of copulatory ducts (vs. more oval-shaped), longer epigyne fissures with almost straight anterior tips (vs. shorter and strongly bent (Fig. 2B, D; cf. Kovács et al. 2015, fig. 5. C–D), and yellow setae not reaching the middle line of pars cephalica (Fig. 4D) (vs. closing in the middle line, Kovács et al. 2015, fig. 1C; Kovács et al. 2010, fig. 2E).

Description. Total length 14.21. Carapace 7.25 long, 5.38 wide. Carapace: dark red-brown in alcohol; black in live specimen; pars cephalica and pars thoracica nearly equally wide; pars cephalica elevated, anteriorly covered with dense yellow setae. Chelicerae with dense yellow setae, covering ca. ½ of cheliceral length. Legs dark brown, with a thin yellow ring of setae at joints. Fe I ventrally with yellow macrosetae. Leg measurements are given in Table 1. Epigyne and vulva as in Figs 2A–D: median lobe subtrapezoidal; epigynal fissures (EF) anteriorly and posteriorly diverging; anterior section of copulatory ducts (ACS) oval, closely situated; spermathecae (S) broad and convoluted, forming numerous small lobes, slightly extending further laterally than ASC.

Male. See Mcheidze (1997); Zamani et al. (2020); see “Note” below. Habitus as in Fig. 4C. Bulbus as in Figs 2E–G.

Habitat. This species is found at altitudes ranging from ca. 800 to 2300 m a.s.l (Suppl. material 1), occurring on the woodland edges, forest clearings, and temperate grasslands.

Distribution. Georgia, Türkiye , Armenia, Iran (WSC 2025), and Azerbaijan (Suppl. material 1). This is the first record from Azerbaijan.

Phenology. The copulation of *E. lavrosii* generally takes place in the second half of spring, when the mean weekly maximum air temperature is around 16 °C. The earliest males appear in late February, and the latest in early June (Suppl. material 1).

Note. Several photographs on iNaturalist show males from southern populations originating in Armenia, Azerbaijan, and Türkiye with a reduced abdominal pattern of different degrees, starting from the posterior edge (see the Reference column in Suppl. material 1). This phenomenon was also observed in *Latrodectus tredecimguttatus* (Rossi, 1790) from the Southern Caucasus, where adult females are characterized by partial or complete abdominal pattern reduction (personal observation by AS).

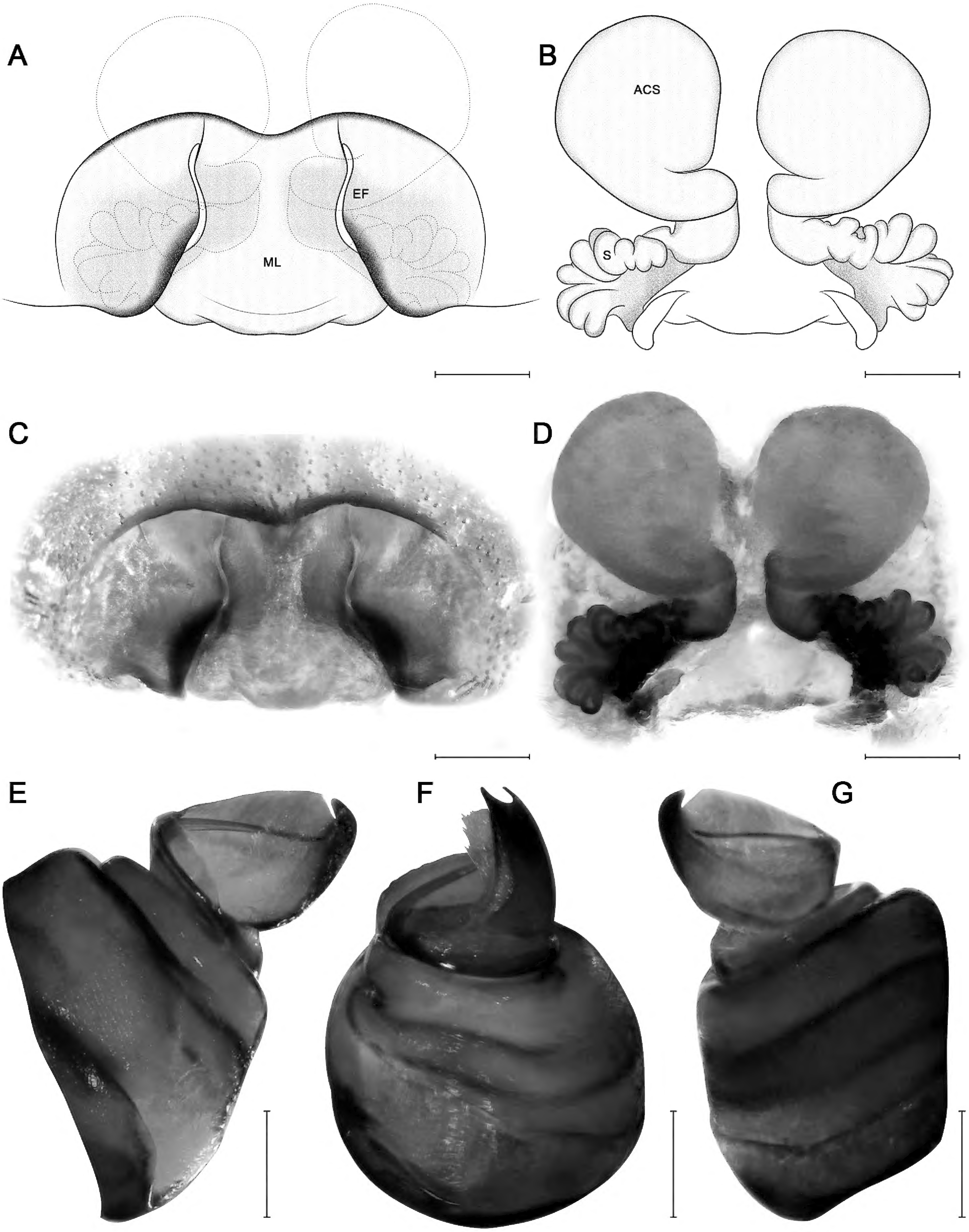

Figure 2. Copulatory organs of *Eresus lavrosii*, Udzo, Kojori (**A**, **C** – female, epigyne, ventral view; **B**, **D** – vulva, dorsal view; **E** – male, bulbus, prolateral view; **F** – ditto, ventral view; **G** – ditto, retrolateral view). Scale bars = 0.3 mm (**A**–**D**); 0.25 mm (**E**–**G**).

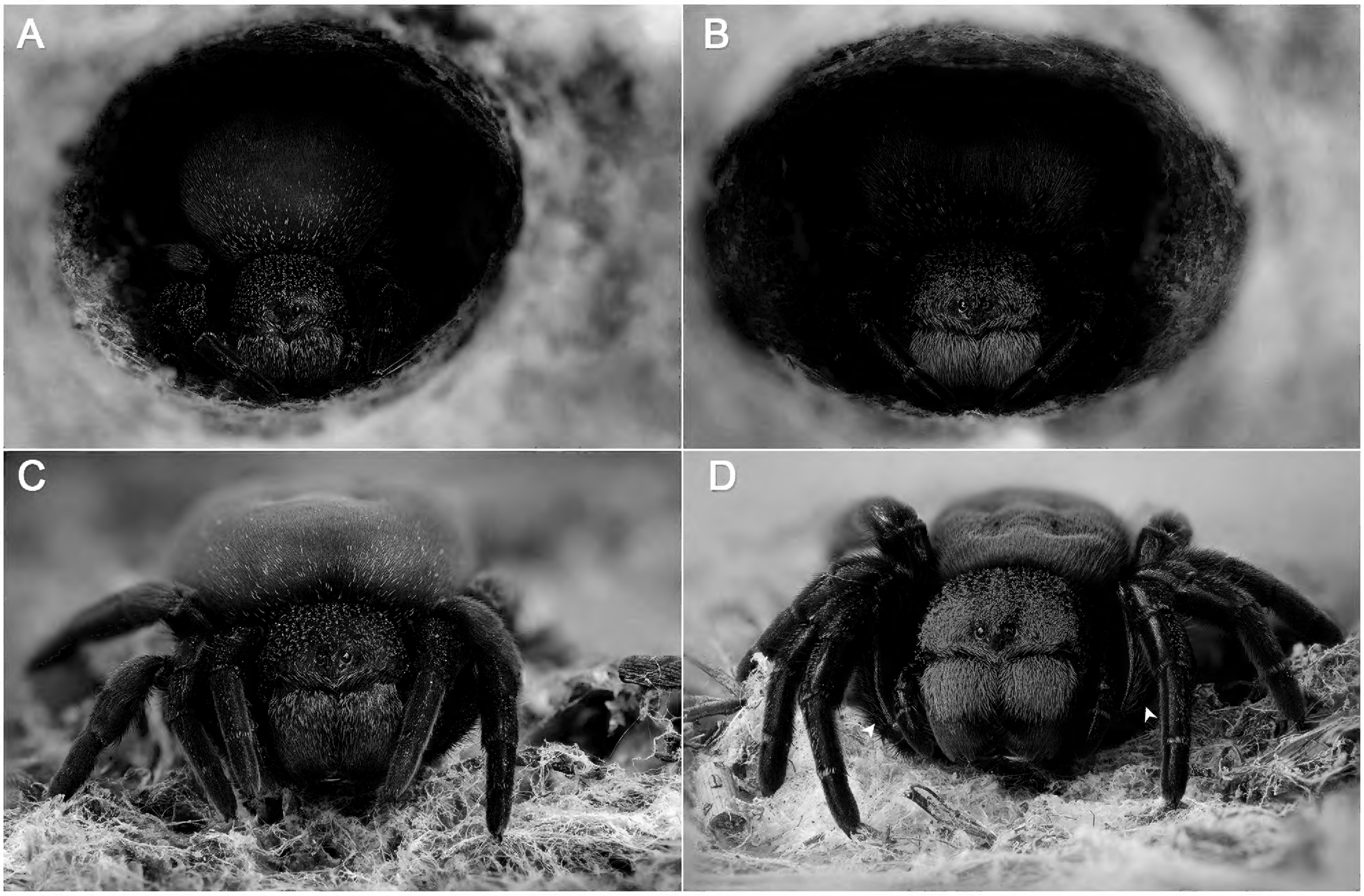

Figure 3. Live specimens of *Eresus lavrosii* (**A** – juvenile, frontal view, Tetrobi Managed Reserve, 15 October 2022; **B** – subadult female, ditto; captive-reared on 27 March 2023; **C** – juvenile, frontal view, Telovani, 29 April 2019; **D** – adult female, ditto, Kojori, 12 May 2019, arrows indicating the characteristic macrosetae on the venter of Fe I). Abbreviations: Fe – femur.

Barcoding. We obtained two identical COI sequences (658 bp) from a male and a female specimen collected in the same burrow (CaBOL-IDs 1037402 and 1037403 (BOLD:AEE3321), *p*-distance 0%). These sequences perfectly match those of *E. lavrosiae* from Turkey (BOLD:AEE3321, *p*-distance 0%), thus confirming the female's identity.

Ecology and diet

The plot in Kojori was chosen to assess the population density, age structure, and viability of *E. lavrosii*. Indicators of population viability were based on density and age structure data; the population with the most individuals and age diversity was considered the most stable. The study area, in the surroundings of the capital of Georgia, Tbilisi, is mainly temperate grasslands, gorges with springs, and broad-leaved forests. The average annual temperature of these three habitats ranges from 8.2 to 9.9 °C, with August being the warmest month and January the coldest (Klein Tank et al. 2002).

Despite the sighting of a single male on 26 April (see Suppl. material 1 and Fig. 4C), due to low temperatures in 2024, the active period of the population study was delayed until the third week of May. In total 80 inhabited burrows

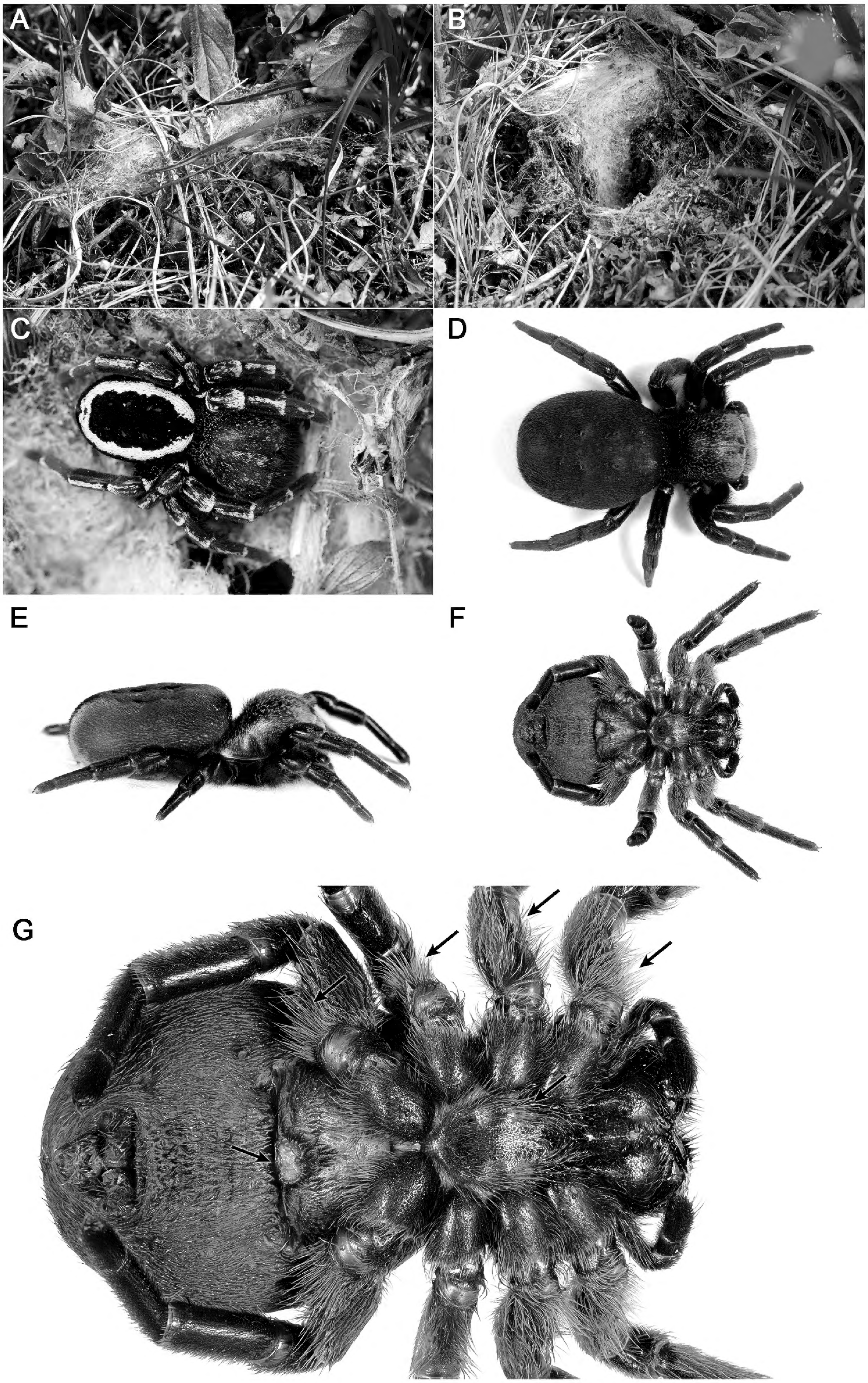

Figure 4. A – intact burrow of *Eresus lavrosii*, subadult female, Kiketi, 29 April 2024; **B** – same burrow with a “lid” raised exposing the entrance to the underground retreat zone, arrow indicating the prey remains at the burrow entrance; **C** – adult male, live specimen, dorsal view, Kojori, 29 April 2024; **D** – adult female, dorsal view, Kojori, 27 May 2024; **E** – ditto, lateral view; **F** – ditto, ventral view; **G** – ditto, arrows indicating the characteristic macrosetae on the venter of Fe I–IV and the SCP. Abbreviations: Fe – femur, SCP – secretion mating plug.

Table 2. Population density and the age structure of *Eresus lavrosii* on the 50 m^2 studied plot at Udzo (Kojori).

D, mm	Life stage	Sex	D, mm	Life stage	Sex
16.85	Adult	NA	18.24	Adult	NA
4.19	Juvenile	NA	19.33	Adult	NA
17.77*	Adult	NA	17.05	Adult	NA
17.96	Adult	NA	18.62	Adult	NA
11.26	Subadult	Female	12.13*	Adult	Female
22.12	Adult	NA	10.14*	Juvenile	NA
18.06	Adult	NA	7.52	Juvenile	NA
8.85	Juvenile	NA	6.47	Juvenile	NA
12.28	Adult	Male	11.13	Subadult/ Adult	NA
4.33	Juvenile	NA	6.52	Juvenile	NA
8.82*	Juvenile	NA	17.9	Adult	Female
7.13	Juvenile	NA	6.71	Juvenile	NA
7.2	Juvenile	NA	4.12	Juvenile	NA
2.97	Juvenile	NA	7.62	Juvenile	NA
7.92	Juvenile	NA	8.67*	Juvenile	NA
15.41	Adult	NA	16.49	Adult	NA
14.87	Adult	NA	18.04	Adult	NA
14.28	Adult	NA	14.25	Adult	NA
17.02	Adult	NA	10.25	Juvenile	NA
10.13*	Juvenile	NA	16.27	Adult	NA
21.11	Adult	NA	11.56*	Subadult	Female
15.68	Adult	NA	15.18	Adult	NA
8.65*	Juvenile	NA	15.26*	Adult	NA
7.54	Juvenile	NA	18.86	Adult	NA
7.21	Juvenile	NA	19.55	Adult	NA
19.61	Adult	NA	14.05	Adult	NA
2.81	Juvenile	NA	11.48	Subadult/ Adult	NA
12.92*	Adult	Male	16.44	Adult	NA
18.09	Adult	NA	8.42	Juvenile	NA
12.85*	Adult	Female	4.81	Juvenile	NA
5.27	Juvenile	NA	8.44	Juvenile	NA
18.56	Adult	NA	6.83	Juvenile	NA
15.01*	Adult	Pair	4.91	Juvenile	NA
14.2	Adult	NA	17.47	Adult	NA
15.45	Adult	NA	20.34	Adult	NA
9.28*	Juvenile	NA	18.56*	Adult	Female
8.22	Juvenile	NA	16.14	Adult	NA
15.1	Adult	NA	18.92*	Adult	Female
14.67	Adult	NA	7.12	Juvenile	NA
14.83	Adult	NA	9.26	Juvenile	NA

D – diameter of the occupied burrow's entrance; asterisk (*) stands for burrows with extracted and checked inhabitants.

were found and measured on the 50 m^2 plot (Dp=1.6) (Table 2). Spiders were extracted from 15 burrows, where a single subadult, six juveniles, and eight adult specimens were recorded. It was not possible to statistically test the difference between subadult and other age classes (Fig. 5), as subadult specimens are usually almost the same size as adults. In contrast, juveniles use burrows with significantly smaller diameters (9.3 mm) compared to those of adults (15.4

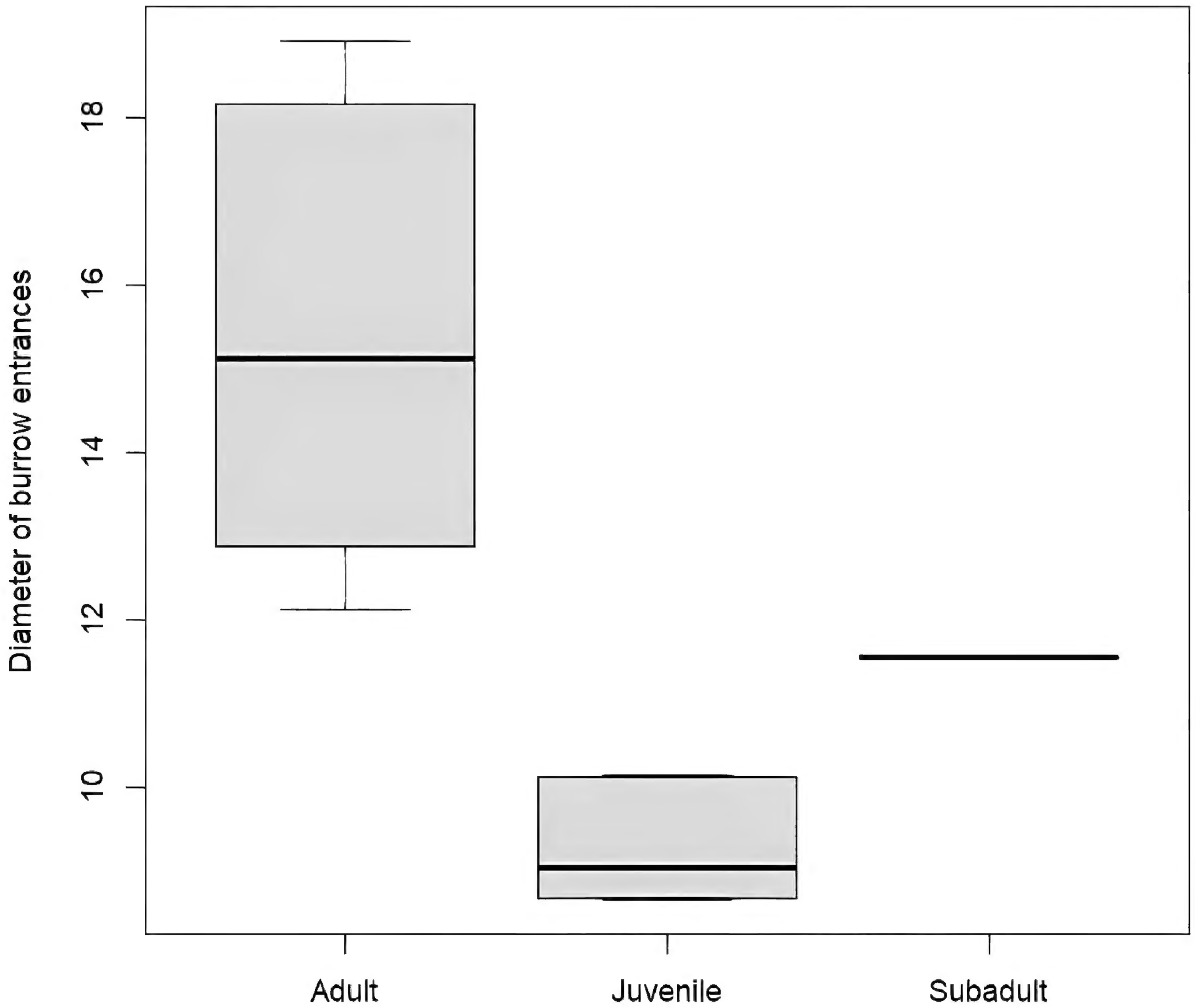

Figure 5. Boxplot showing the extrapolated data-based age structure of *Eresus lavrosii* population at Udzo.

mm) (t8=6.1; *p*<0.001). Consequently, within the studied population we used the mean value of burrow diameter for each class to extrapolate the age distribution within the remaining 75 observed burrows. As a result, 32 burrows were occupied by juveniles and the rest by adults (juvenile-adult/subadult ratio: 1–1.5). Considering the density and height of the vegetation layer, as well as the challenge of detecting aboveground parts of burrows (particularly the smaller ones), the actual density of inhabited burrows is most likely higher than that observed (see next paragraph). The variation in the studied population's age structure, its density, and relative proximity to the neighbouring population (approximately 500 metres) confirm its high viability, albeit excluding potential human intervention (Suppl. material 1).

In total, 110 spider webs (70 adult and 40 juvenile burrows) were collected from the study plots a month after measuring burrows. These contained 888 prey remains (636 in adult webs, 252 in juvenile), representing at least 87 taxa from 10 orders of arthropods (Fig. 6, Suppl. material 2). It is worth noting that at the time of the web collection, all adult females were found with cocoons. The results revealed the wide prey spectrum of *E. lavrosii* from Udzo, from large arthropods, such as ground beetle *Carabus adamsi* Adams, 1817 and European field cricket (*Gryllus campestris* Linnaeus, 1758), to small insects, such as ants *Tetramorium* sp. Mayr, 1855 and weevil beetle *Ceratapion onopordi* (Kirby, 1808). The diet of adults was mainly composed of Coleoptera, Formicidae, *Armadillidium* sp. Brandt, 1833, Isopoda, and *Cylindroiulus* sp. Verhoeff, 1894 millipedes, making up to 78% of the remains in the spider webs. In striking contrast, ants dominated other prey taxa in the juveniles' diet, making up more than 62% of the prey in their webs, compared to ≈20% in adults. Based on the

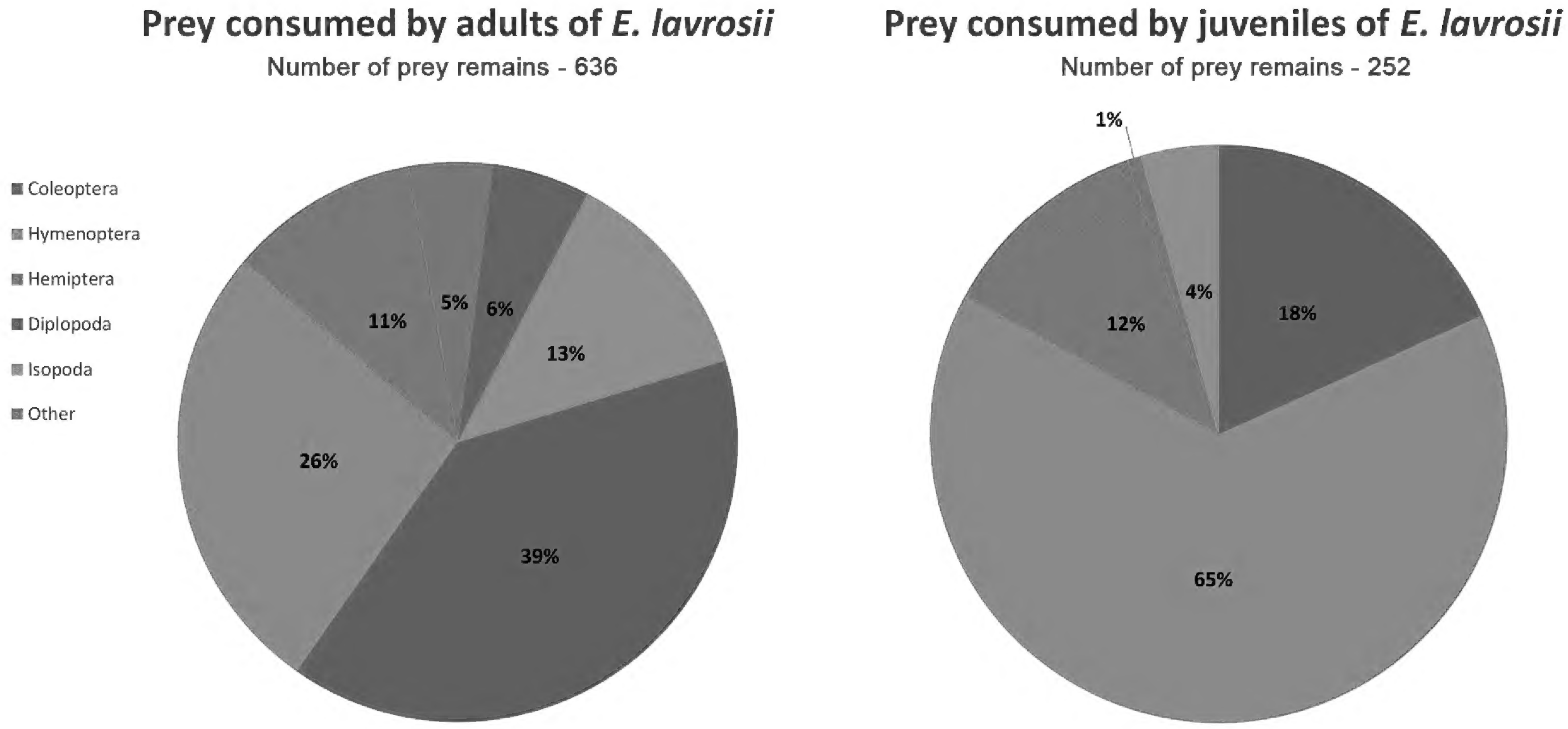

Figure 6. Diet composition of adults and juveniles of *Eresus lavrosii* from Udzo population.

above, it is likely that ants (at least *Tetramorium* sp.) found in the adults' webs, were consumed by spiders during their juvenile stage. Coleoptera was the second-most abundant prey in the diet of juveniles (≈18%). The abundance of Coleoptera, Formicidae, Isopoda, and Diplopoda remains in webs of the population from Udzo suggests these are the dominant groups of ground-dwelling arthropods in the area, highlighting that *E. lavrosii* has a generalist diet.

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Additional information

Conflict of interest

The authors have declared that no competing interests exist.

Ethical statement

No ethical statement was reported.

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Author contributions

Conceptualisation: AS, GK. Material collection: AS, NB, GM. Writing - original draft: AS, GK. Visualization: AS, GM.

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Data availability

All of the data that support the findings of this study are available in the main text or Supplementary Information.

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Supplementary material 1

Known distribution and seasonal activity of *E. lavrosii*

Authors: Seropian et al.

Data type: occurrence

Explanation note: Geographic coordinates, elevation above sea level, collection date and life stage along with source information is given.

Link: https://doi.org/10.3897/caucasiana.4.e151922.suppl1

Supplementary material 2

Prey taxa, number of individuals, prey size, and burrow diameter

Authors: Seropian et al.

Data type: mixed

Explanation note: In the table the identity of pray taxa and individual number along with burrow diamter are given for each of the studied burrow.

Link: https://doi.org/10.3897/caucasiana.4.e151922.suppl2